REMARKS

In the last Office Action, claims 1-3 and 5-7 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,956,565 to Yamashita. Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Yamashita in view of U.S. Patent No. 6,670,717 to Kane et al. ("Kane"). Claim 8 was rejected under 35 U.S.C. §103(a) as being unpatentable over Yamashita in view of U.S. Patent No. 6,207,575 to Yang et al. ("Yang"). Claims 31-32 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yamashita in view of U.S. Patent No. 6,668,628 to Hantschel et al. ("Hantschel"). Claims 33-34 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yamashita in view of U.S. Patent No. 6,437,343 to Okazaki et al. ("Okazaki"). Claims 33 and 35 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yamashita in view of Japanese Patent No. 10-223170 to Hitachi. Claim 37 was rejected under 35 U.S.C. §103(a) as being unpatentable over Yamashita in view of U.S. Patent No. 5,683,547 to Azuma et al. ("Azuma").

In accordance with the present response, claims 1, 3, 5-8 and 37 have been amended to further patentably distinguish from the prior art of record. Claim 2 has been canceled without prejudice or admission. New claim 38 has been added to provide a fuller scope of coverage. The

previously submitted abstract has been amended to more clearly reflect the invention to which the amended claims are directed. Claims 1, 3-8, 31-35 and 37-38 are currently pending in this application.

Applicants request reconsideration of their application in light of the foregoing amendments and the following discussion.

The present invention relates to a method of cross-sectional processing and observation.

As described in the specification (pgs. 2-3), a conventional method related to the method of the present invention involves the formation of a cross-sectional exposed portion in a desired area in a sample surface and observation of the exposed cross-sectional portion through a scanning ion microscope image using a focused ion beam or a scanning electron microscope (SEM) image using an electron beam. However, such conventional method has been associated with the problem of insufficient resolution for observation as a result of using the scanning ion beam microscope image or SEM image. The specific problem is that the resolution is insufficient to manage the very small thickness of the film structures being observed.

Another conventional method involves etching a desired area in a sample surface with a focused ion beam to take out a sample chip and observing the sample chip with a transmission electron microscope (TEM). However, this method has been determined to be time consuming and expensive to carry out.

Moreover, the foregoing conventional methods have only been capable of providing information on the geometry of a sample, not on electrical and mechanical characteristics of the sample.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-2 show an embodiment of a method of cross-sectional processing and observation according to the present invention embodied in amended independent claim 1. According to the method of the present invention, in a first step at least one predetermined area 13 in a surface of a sample 12 is processed to form a target cross-section by etching the at least one predetermined area 13 with a focused energy beam using a focused energy beam irradiating unit 1 in a vacuum chamber 3. In a second step, the target cross-section is observed by scanning the target cross-section with a probe of a scanning probe microscope 6 in the vacuum chamber and detecting a physical quantity produced between the probe and the target cross-section.

Amended claim 6 is directed to another embodiment of a method of cross-sectional processing and observation and requires the removal of a damaged portion (region 15) remaining in the exposed target cross-section and the subsequent formation of a stepped portion 16 according to a difference in materials among layers forming the exposed target cross-section.

By the foregoing methods, a sufficient spatial resolution for observing the formed or exposed target cross-section of the sample is achieved as compared to the conventional art. Furthermore, the methods according to the present invention facilitate the acquisition of electric, magnetic, and mechanical information for a target sample plane.

The prior art of record does not disclose or suggest the combination of steps recited in pending claims 1, 3-8, 31-35 and 37-38.

Rejection Under 35 U.S.C. §102(b)

Claims 1, 3 and 5-7 were rejected under 35 U.S.C. §102(b) as being anticipated by Yamashita. Applicants respectfully traverse this rejection.

Independent claim 1 has been amended to recite a method of cross-sectional processing and observation and

requires a first step of processing at least one predetermined area in a surface of a sample to form a target cross-section by etching the at least one predetermined area with a focused energy beam using a focused energy beam irradiating unit in a vacuum chamber, and a second step of observing the target cross-section by scanning the target cross-section with a probe of a scanning probe microscope in the vacuum chamber and detecting a physical quantity produced between the probe and the target cross-section. No corresponding steps are disclosed or described by Yamashita.

Yamashita discloses a method for observing the cross-section of a sample using an AFM apparatus in a vacuum, the AFM apparatus being connected to an FIB apparatus via a gate valve 15 (Fig. 1; col. 5, lines 50-53). As shown in Figs. 4(a)-4(d), the sample is diced, an unevenness is formed on the wall of the diced sample using the FIB, and the wall surface is observed using the AFM. This procedure requires the diced sample to be exposed to ambient air after application of the FIB.

In contrast, amended independent claim 1 recites a first step of processing at least one predetermined area in a surface of a sample to form a target cross-section by etching the at least one predetermined area with a focused energy beam using a focused energy beam irradiating unit in a

vacuum chamber, and a second step of observing the target cross-section by scanning the target cross-section with a probe of a scanning probe microscope in the vacuum chamber. Stated otherwise, in amended independent claim 1 both the processing of the surface of the sample and the observation of the processed surface of the sample take place in a vacuum chamber (i.e., the same vacuum chamber), and there is no exposure of the sample to ambient air during or between these steps.

In the absence of the foregoing disclosure recited in amended independent claim 1, anticipation cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration"); Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found"); Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added) ("Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim").

Stated otherwise, there must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. This standard is clearly not satisfied by Yamashita for the reasons stated above. Furthermore, Yamashita does not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Yamashita's method to arrive at the claimed invention.

Claim 5 has been rewritten in independent form and requires the steps of providing a system for cross-sectional processing and observation comprised of a processing unit for processing a surface of a sample and a scanning probe microscope unit both disposed in a single vacuum chamber, processing at least one predetermined area in the surface of the sample to expose a target cross-section thereof using the processing unit, and observing the exposed target cross-section by scanning the exposed target cross-section with a probe of the scanning probe microscope unit. No corresponding combination of steps is disclosed or suggested by Yamashita as set forth above for amended independent claim 1.

Amended claims 3 and 6-7 depend on and contain all of the limitations of amended claims 1 and 5, respectively, and, therefore, distinguish from Yamashita at least in the same manner as claims 1 and 5.

In view of the foregoing, applicants respectfully request that the rejection of claims 1, 3 and 5-7 under 35 U.S.C. §102(b) as being anticipated by Yamashita be withdrawn.

Rejections Under 35 U.S.C. §103(a)

Claims 4, 8, 31-35 and 37 were rejected under 35 U.S.C. §103(a) as being unpatentable over various combinations of the references to Yamashita, Kane, Yang, Hantschel, Okazaki, Hitachi and Azuma. Applicants respectfully traverse these rejections.

The primary reference to Yamashita does not disclose or suggest the combination of steps recited in independent claims 1 and 5 as set forth above for the rejection under 35 U.S.C. §102(b). Claims 4, 8, 31-35 and 37 depend on and contain all of the limitations of amended claims 1 and 5, respectively, and, therefore, distinguish from Yamashita at least in the same manner as claims 1 and 5.

The secondary references to Kane, Yang, Hantschel, Okazaki, Hitachi and Azuma have been cited by the Examiner as teaching the various selected features recited in claims 4, 8 31-35 and 37. As recognized by the Examiner, however, these references do not teach the specific steps recited in amended claims 1 and 5, from which claims 4, 8, 31-35 and 37

respectively depend. Accordingly, these references do not cure the deficiencies of Yamashita as set forth above for claims 1 and 5, and one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejections of claims 4, 8, 31-35 and 37 under 35 U.S.C. §103(a) as being unpatentable over various combinations of the references to Yamashita, Kane, Yang, Hantschel, Okazaki, Hitachi and Azuma be withdrawn.

New claim 38 depends on claim 6 which depends directly on amended claim 5. Accordingly, claim 38 distinguishes from the prior art of record at least in the same manner as set forth above for amended claim 5.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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